Collaboration Tools

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Abstract

Students use technology in natural ways that allow them to do what they want: communicate with anyone they want, in the time and space that suits them best. Easily accessible and user-friendly, collaboration tools allow students to explore, share, engage, and connect with people and content in meaningful ways that help them learn. By relying on the familiar ways students use these tools, faculty can enable new forms of communication and engagement in the classroom, permitting extensions and variations of the informal interactions already occurring in classrooms and hallways, and creating new frontiers for collaboration across geographic boundaries.

Collaboration: The action of working with one or more other people to produce or create something

Tool: A device or implement, especially one held in the hand, used to carry out a particular function

As a graduate student and young academic at a U.S. institution, Ayla was excited to trade her lab coat for a suit and attend a professional conference in Europe. After months in the laboratory, she finally had results (and a research grant to pay for overseas travel) and would present a poster session on her findings. At the conference, she would encounter many of the "superstars" in her field, while glimpsing emerging research from her colleagues.

At the conference, Ayla was excited to discover that many of her European peers were interested in collaborating with her on future experiments, which might lead to a paper in a major academic journal. They suggested scheduling an extended meeting at an upcoming regional conference. Although Ayla knew that these researchers frequently see each other at conferences in different parts of Europe, Ayla did not have the time or the budget to regularly travel overseas. They decided a Skype call or two would be the ideal way to start.

Two weeks later, Ayla "dialed" her potential collaborators through Skype, a voice over Internet Protocol (VoIP) application that lets users make free calls between Skype-equipped computers. At the start of the call, Ayla asked for permission to record the call to capture the details. For two hours, the researchers discussed their mutual projects and where a potential collaboration might take place. As details emerged, Ayla sent a link to a shared document in Google Docs and captured their ideas—in real time—for her international colleagues. By the time the phone call concluded, they had a working outline, a shared workspace, and a digital recording of their first conversation.

Technology use in higher education has historically enabled new forms of communication and collaboration. The advent of faster communication tools—from two-way audio/video to instant messaging (IM)—has allowed colleagues and collaborators to transcend the physical distances that separate them, offering a faster transfer of knowledge and quicker feedback on new ideas and results. Once seen as mere stand-ins for face-to-face meetings, today's collaboration tools feature text annotation, video, audio, and other synchronous tools that allow multiple "hands" to manipulate ideas, objects, and concepts from remote locations.

On college campuses, students have been the pioneers of these tools, whether or not they've understood the significance of such tools in an educational context. Creating affinity groups on social networking sites like Facebook, exchanging links over IM conversations, or building group projects in Google Docs, "millennials" have seamlessly integrated the social tools they use for communication with friends into their academic toolkit, taking advantage of the synchronous, collaborative nature of Web 2.0 tools to share content with peers or discuss common classroom problems.

In a 2007 study of college undergraduates, roughly 41 percent of students surveyed said they use wikis, which operate like shared workspaces for collaborative editing.[1] More than 80 percent belong to social networks such as Facebook, which became the center of a disciplinary action at Ryerson University, in Toronto, in March 2008 when a student faced 147 academic charges for running an online chemistry study group where classmates could exchange questions and homework tips. The student, 18-year-old Chris Avenir, argued that if the online resource sharing was cheating, "then so is tutoring and all the mentoring programs the university runs and the discussions we do in tutorials."[2]

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Among high school students, a national study conducted by Project Tomorrow found that 44 percent regularly use e-mail and IM to stay in touch with their peers about class assignments.[3] The Pew Internet & American Life Project reported that 64 percent of teens have participated in some type of content creation on the web. Thirty-nine percent shared their artistic works online, and 26 percent said they "remix" existing online content to create new works. Among those who post content online—from photos to videos—most reported some interaction with members of the community through posted comments.[4]

To paraphrase Arthur C. Clarke, good technology in the hands of skilled practitioners should be indistinguishable from magic. It should allow individuals to do what they want naturally. Its use should be driven by the needs of individuals. Ideally, it should allow users to extend the boundaries of what they are able to achieve and, at the very least, help people to perform better.

Our students are turning out to be the skilled practitioners performing this magic. Students use technology in natural ways that allow them to do what they want: communicate with anyone they want, in the time and space that suits them best. In an almost stealthy manner, the tools at their disposal have given students a new perspective on the world by allowing them to explore, share, engage, and connect in meaningful ways that help them learn.

By relying on the familiar ways students use these tools, faculty can enable new forms of communication and collaboration in the classroom, permitting extensions and variations of the informal interactions already occurring in classrooms and hallways. Those same tools may have applications in faculty research as well, opening new frontiers for collaboration among colleagues across geographic boundaries.

This white paper explores the nature and characteristics of effective collaboration tools, with a particular emphasis on existing and emerging tools that offer exceptional promise for the future of academic collaboration.

Defining Collaboration

Across higher education, the word *collaboration* has become synonymous with effective scholarship and collegiality. Proposals for institutional projects typically require interdepartmental collaboration. Faculty are asked to demonstrate collaboration in pursuit of common societal advances, and students are asked how they value and exemplify teamwork in job interviews and on graduate school applications.

But what is effective collaboration?

If we look at Wikipedia, itself a symbol of collective intelligence and collaboration in a Web 2.0 world, collaboration is "a recursive process where two or more people...work together toward an intersection of common goals...by sharing knowledge, learning, and building consensus."[5] Against the backdrop of an increasingly shrinking world, "two or more people" may be separated by mere walls or vast oceans. In academia, "common goals" may be the pursuit or creation of new knowledge in a research setting or a team project in a classroom.

For the purposes of this paper we define *collaboration tools* as those that enable remote collaboration. In many cases, a collaboration tool is synonymous with a communication medium or device. However, given the rapid introduction of new tools and the almost as speedy demise of tools that don't find a critical mass of users, identifying characteristics of effective tools may help uncover tools that are already being used within disciplines. In addition, identifying features of effective tools may guide developers in creating next-generation tools.

When people are asked to define or suggest collaboration tools, audio conference systems and videoconferencing software typically top the list, reflecting a traditional view that collaboration tools should mimic face-to-face meetings in front of a chalkboard. Perhaps reflecting the predispositions of those designing them, these tools have often emphasized sharing of the physical characteristics of people. While such tools are important and will likely continue to be the mainstay of collaboration tool suites for many years, several emerging tools are spawning social practices that may prove to be invaluable in bridging more than just the physical distance between participants. These emerging practices may ultimately usurp more conventional modes.

Predicting which communication device/medium will make a good collaboration tool can be a tricky business. A good tool should

- promote communication;

- share a diagram, photograph, paper, or similar objects;

- allow natural interactions; and

- be easy to use and learn.

Beyond these basic and, perhaps, traditional characteristics, today's collaboration tools enable persistent micro-interactions—or the sharing of almost trivial updates between collaborators. These interactions, which might not warrant a phone call or extended conversation, typically include very minor details about a collaborator's work or life, allowing for an intimate knowledge of colleagues over long periods of time. The face-to-face equivalent of this interaction might come from sharing an office with a colleague for several months.

Collaborators can also share in virtual environments, which are not subject to the physical constraints present in real life. A collaborator might, for example, "teleport" to another location on a whim, creating an opportunity for interaction on a neutral playing field or allowing the meeting itself to become an opportunity for creativity and exploration.

Other collaboration tools support a back channel that is difficult to replicate in real life, creating multiple layers for communication. A faculty member might deliver content from the front of the room, for example, while students collaborate on lecture notes in a synchronous text environment.

Features of Collaboration Tools

While communication is often an integral feature of collaboration tools, it is not the only feature. Any tool that allows interaction on a shared resource has the potential to be a collaboration tool. Determining the factors that increase the likelihood that a tool can attract a critical mass of users may shed light on what facilitates effective collaboration. A natural interface with interactions based on existing communication norms is particularly valuable.

Taking a cue from traditional face-to-face interaction, many collaboration tools have tried to emulate non-technology-mediated interactions. These have included sharing images and video of participants, creating shared spaces or rooms, and facilitating other elements believed to be important in establishing an appropriately correct environment for collaboration.

But what sets a collaboration tool apart from mere communication tools?

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- **Strong Communication Capability:** Perhaps through video, audio, or simple text, the most important feature of a collaboration tool is its ability to facilitate communication and interaction between participants.

- **Easy-to-Understand Interface:** The interface of the tool should be easy and intuitive to navigate, perhaps emulating an existing tool or an aspect of the physical world. A user's ability to simply pick up, adapt to, and use a tool considerably diminishes extensive training and supervision needs. For example, each successive generation of an IM tool builds on the previous one, making it easy for users to figure out how to use it. Incremental changes and version features allow for an evolution of the tools.

- **Capability and Expectation of Collaboration:** To encourage input from participants, a collaboration tool should make it clear that input is expected and will elicit a response. For example, it should be clear whether and when it is acceptable to collaborate in this space. Is collaboration expected? Does the tool support taking turns or sharing of "airtime" in this space? An online presentation can be an ideal tool for collaboration, for example, but only if it is clear to the audience that they should be responding to the presentation and interacting with participants instead of passively watching a webcast.

Today's Technologies:
New Features, New Opportunities

Today's Web 2.0 technologies are expanding the list of collaborative tools, taking advantage of a growing base of content creators and online experimenters to transition social tools into opportunities for academic collaboration and innovation. We can group these tools based on the activities and opportunities they enable:

- Immediacy
- Enhanced voice communications
- Ambient communications
- Image sharing
- Document construction
- Social interaction
- Geographic richness

Immediacy

The potential of IM as a collaboration tool should not be overlooked. IM, sometimes referred to as *chat* or *text chat*, is a versatile, accessible, and almost universally available tool that supports collaboration in multiple ways. IM is generally viewed as a platform to support synchronous text communication between two or more people using computers, and it excels at that. But it is much more. Many chat/IM client applications support audio chat, video chat, file transfer, and even desktop sharing in addition to simple text chat. Perhaps the greatest feature of IM is the number of people who use it and know how to use it. IM is almost as ubiquitous as e-mail. Indeed, web-based IM is included in all Gmail accounts. Other applications, including Facebook, are building IM into their interfaces. Whether or not you like IM, you will know how to use it.

Using IM requires that a user have an account with a service—such as Gmail, Yahoo, or AOL Instant Messenger (AIM)—and a client application located on the user's computer. Because

IM is hosted by a service provider, the network presence, availability, and scalability allow IM users to communicate with other people regardless of service provider or IM client. For example, users with an AIM account can easily communicate with people with a Microsoft Network (MSN) account or an Apple MobileMe account. Once users have an account (usually free) with a service provider and a client application (also usually free) installed on their computer, they can easily text chat with other users anywhere in the world. With client applications that support it, they may also be able to audio chat, video chat, and exchange files through the IM application.

Enhanced Voice Communications

Making a phone call is a natural vehicle for communicating with friends, family, and colleagues. However, toll charges can limit time spent in conversation, and a single audio channel limits interaction. Integrating one-to-many voice and video conferencing, recording conversations, and chat offers multiple channels for communicating, sharing, and documenting.

Skype

Skype is a VoIP application that allows users to collaborate over voice channels by calling one another. Skype users download and install a client application, allowing them to use their computers as phones. They can make free voice calls to other Skype users on the network.

Skype has caught the imagination of millions of users around the world. By promising free phone calls at a time when users were increasingly unhappy about the cost to make calls, particularly international ones, Skype was soon installed on millions of computers, taking advantage of the value of multiple nodes. For collaborators, Skype allows longer and more frequent interactions, eliminating cost constraints and creating opportunities to record conversations and engage in multiuser conversations. Foreign-language programs have adopted the tool to encourage conversations between students and native speakers, and researchers have taken advantage of recording capabilities to create another opportunity for archiving conversations and interview notes or making academic podcasts to share research.

Ambient Communications

The ability to ask a question of experts, friends, or acquaintances at any time, regardless of location, provides new levels for sharing and communication. Many tools enable individuals to tap into their network whenever they need help—or even when they don't have much to share.

Twitter

If you have ever had the experience of constantly asking someone in close proximity "what are you thinking about," you intuitively know what it is like to use Twitter. Twitter is designed to support micro-interactions—the incessant flow of the thoughts of a friend or colleague that stream across your screen. So-called tweets are short—limited to 140 characters—and can be viewed synchronously or asynchronously. Often disjointed, tweets are valuable because of their brevity, their spontaneity, and the context generated by familiarity—either through actually knowing someone or from following their tweets.

Faculty have used the tool to create an ongoing back channel in the classroom, opening a Twitter feed for students to share links, resources, and notes, even as a lecture continues at the front of the room. Conference planners have taken advantage of the tool to offer a place for community dialogue "behind the scenes" as users comment on sessions, share links and resources, or invite others to participate in face-to-face meetings and interactions.

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For all its potential annoyances, Twitter gives its community (often called the *twitterverse*) the ability to connect and share deeply. Individuals are able to keep up with the latest updates of friends and colleagues from all over the world. Integration of Twitter with other tools allows sharing of rich media including URLs, pictures, videos, and other items. Twitter is easy to use and versatile, and its community is constantly finding new uses for it.

Image Sharing

Sharing images or photographs is emerging as a new way to establish a common starting point with potential collaborators. Image-sharing sites allow individuals to selectively share pictures, which can become social objects around which users can congregate.

Flickr

The photo-sharing site Flickr is ostensibly a place to share experiences. Through its use of technologies that enhance sharing, however, Flickr qualifies as an online collaboration tool centered around images and visuals.

Flickr accounts are free, and users are encouraged to upload their photos to the site. Using local photo-management software to seamlessly put their pictures online, users can share images with the entire online community, with small groups of colleagues, or with no one at all. Viewers and creators alike can annotate photos, add comments, or even assign freely chosen keywords as tags. Using a "notes" tool, users can highlight parts of a photo by drawing a box around it and then attaching a note. Pictures can also be commented on and collected into groups where discussions can be facilitated. These features have made it a popular tool for art courses, where faculty encourage student to post their work for the community to review and make suggestions. Scientists have used the site to share, critique, and analyze visual information.

Flickr incorporates Web 2.0 communication tools and has become a site where people meet to share and discuss images. Some people also use the site to emulate the activity of working together on an image. Analysis, comparisons, annotations, publishing, and remixing can all be facilitated using Flickr.

Document Construction

Doing away with the traditional—and often laborious—process of peer editing by exchanging multiple drafts, today's electronic documents allow collaborators to work in a synchronous environment on a single document, essentially peering over each other's shoulders as they type. Co-writing a shared document in real time can prove an effective tool for brainstorming and collectively articulating ideas.

Google Docs

Google Docs is one of several online tools that allow individuals to work together on a shared document. The experience mimics working on a document through word-processing software, except that the work is conducted online and other collaborators can work together in real time.

In the past, collaboration on a document would involve passing a document back and forth between authors. Each author would take a turn at improving the work, often correcting, modifying, or building on the work of the other authors. Even with the use of features that track changes, the process could be very tedious and error-prone, opening the door to the loss of changes due to version-control issues, formatting problems, and sometimes the loss of information about who made particular changes.

With Google Docs, authors can work on the same document in real time. Changes can be tracked and attributed, and the document can be shared with a larger group of authors and reviewers as it becomes more polished. Contributors are able to co-author—sometimes even simultaneously—a digital document, creating opportunities on campus for real-time peer editing and research collaboration.

Social Interaction

Who do you know, how do you know them, and are you willing to admit it? This is the question social interaction tools like Facebook and LinkedIn ask. In the process of articulating relationships, users can take advantage of common links and interests to build shared networks and affinity groups.

Facebook

Facebook is an environment that encourages people to connect with others through a social networking platform. Users create profiles to share information about themselves, including their education, interests, and their social goals. Facebook users are also encouraged to find all of the people they are connected to, whether through contacts made offline or through common interests. Facebook makes it particularly easy to publicly share interests or loyalties with others and to promote connections based on interests.

Can Facebook be considered a collaboration tool? As a very "sticky" application (one that users visit often and tend to stay on for extended periods of time), it has a rich feature set that continues to evolve. Facebook is also growing rapidly. While it started off as a tool exclusively for college students, it has quickly penetrated many nonacademic peer groups. Usage is almost ubiquitous among North American youth under 25.

Facebook is being used to facilitate serendipitous connections between friends and contacts. It also brings people with similar interests together, from students creating a group page to organize and discuss a project to classrooms creating a shared space to post notes and common questions. Given its potential to integrate deeply into the practices of a large number of people, it holds great promise as a collaboration tool.

Geographic Richness

Geographic and mapping tools use the power of location to create spatial connections between users, adding a layer of information for users to share and contribute to.

Google Earth

Google Earth is a client application installed on local PCs and uses browser plug-ins and an Internet connection to provide rich, visual, geographic data. Other features enable users to contribute personal coordinates to the data exhibited in Google Earth. Users are encouraged to upload their own sites and pinpoint their location on the map. Browsers can view locations of interest and simultaneously view the annotations contributed by the user community. By viewing the aggregated collections of favorite spots, users participate in richer interactions related to place, spawning conversations around a common interest in locations.

While location-based applications are still in their infancy, considerable effort is going into identifying useful applications that capture how users would like to interact with and share their location information.

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Collaboration Tool Features: A New List?

With these technologies in mind, we might add new features to our list, including features that may permit or promote new and different types of collaboration. Their inclusion in emerging tools gives each its own feel and culture and may promote entirely new types of interaction.

- **Multiple Collaborators:** How many collaborators can contribute with a particular tool? What is the limit on the number of collaborators for an effective interaction? For example, a phone call is usually a dyad, while a conference call can include several participants. Yet, there is a limit on how many people can actively participate in a conference call.

- **Synchronous versus Asynchronous Collaboration:** Does the tool support instant, real-time collaboration, or is the interaction more of an iterative process based on taking turns? Twitter, IM, and chat are synchronous; e-mail is iterative. However, while Twitter, IM, and chat transcripts can be saved for asynchronous viewing later, there is always a time delay between sending an e-mail and getting a response. It may not be long, but it is not instantaneous in the way that Twitter, IM, and chat sessions are.

- **Role-Based Sharing:** How are products of the collaboration shared? Are they made public, or can they be restricted to only those who participated? Can the collaboration be shared with wider audiences as it becomes more refined? Blogs and wikis may be configured as "open" or "moderated" based on the preferences and objectives of the creator(s).

- **Discoverable Collaborators:** Do collaborators find one another through prearranged channels or personal connections, or are they able to find one another through a common interest in a topic? Can collaborators find one another by shared interest? Are they able to associate by location or by affiliation? Many social networking sites require an invitation to join an affinity group. Some membership sites require a reference from a member, while others are completely open to anyone who wants to join. Does exclusivity ensure a more robust network?

- **Ownership of Contribution:** Is it clear who "owns" a particular contribution? Can you track contributions and attribute them to specific authors? In some tools, collaborators are represented by different colors. Are collaborators able to modify the work of others? Can the history of the shared resource be tracked?

- **Playful or Engaging:** Is the collaboration tool playful? A tool like Flickr encourages playful dialogue around photos and themes. Second Life encourages play. MySpace and Facebook actively promote playful interactions between multiple participants.

- **Social:** Is the tool social? Does it permit serendipitous discovery of peers, friends, and topics of interest leveraging your existing network? Does it allow you to post updates (or micro-updates) about yourself? Are you able to connect to and work with those of your network with whom you are most compatible?

Shortcomings of Collaboration Tools

For every effective collaboration tool with well-implemented features, there are tools that do not succeed. The shortcomings of failed projects range from simply having an unintuitive, clunky interface to being too expensive or requiring too much hardware. Lotus Notes is an example of a powerful, multifeatured collaboration tool that imposed too large a resource burden on users and administrators and was not able to successfully make the transition from proprietary server/client application to accessible, user-friendly web application.

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The challenge for any collaboration tool is to offer a combination of the following features:

- Richer experience than any previous tool
- Easier to use than other tools
- More cost-effective than competing tools

A new tool may earn an advantage by emulating an existing tool and building a loyal user base. These loyal users may then discover the potential of the tool to support new uses and connections.

Finally, a tool should not appear before its time. It is possible for a tool to be released that is so radically different, so unlike other tools, that it will bewilder potential users. The Apple Newton was too far ahead of its time but became the foundation for subsequent handheld mobile devices. Finding compelling, powerful, yet easy-to-use tools with the features that keep users engaged and happy is a daunting challenge.

Implications for the Future

While Internet tools are ushering in new capabilities for collaboration, knowledge creation, and collective intelligence, traditional collaborative activities are also being enhanced by these tools. Participants can connect and communicate through more and richer channels to augment conversation. In addition to communication by talking, collaborators can add video, shared desktops, shared PowerPoint slides and flowcharts, and group Internet browsing. The sharing of additional media can happen in an impromptu manner that sometimes allows individuals to spontaneously reveal aspects of themselves. Tools that feel natural are more likely to promote greater flexibility with interactions. In addition to facilitating traditional collaborative relationships between parties that know one another, these tools also promote serendipitous collaborations among strangers. Interested parties can find and identify one another based on common interests and shared affiliations.

Additional channels allow participants to employ the medium that best fits a particular communication and learning style. Visual collaborators can add a shared image, auditory collaborators can post audio files or use VoIP tools, and people who prefer text have multiple avenues of collaboration.

New collaboration tools and associated best practices are emerging almost daily. While users may feel frustrated with their ability to keep up with the very latest, this frustration may be misplaced. Instead, we might focus on the process of integrating a new tool for collaboration:

- Think twice before discarding a tool that works.
- In general, the tool that people know how to use and feel comfortable with and that is the first one they reach for is probably the tool to use.
- Any new tool should introduce new capabilities over the tool it replaces.

Important improvements are those that permit or promote new and better ways of doing things. The tool that allows cheaper voice communication may gain a foothold against a more expensive tool. The tool that permits sharing of files during a voice communication may win fans for its convenience. The tool that seamlessly integrates with other tools is more likely to be adopted.

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Ultimately a tool should respect user time and reflect the values of the user. While a tool may appear to be a neutral communication medium, the uses that fans and users come up with is likely greatly influenced by the features and capabilities of the tool itself.

For Ayla and her international collaborators, Skype provided a unique opportunity to hold a real-time conversation at very little cost, transforming the tool from a mere communication device to an opportunity to hold impromptu planning meetings with collaborators separated by thousands of miles. The use of a VoIP system instead of e-mail exchanges gave Ayla enough insight about her colleagues to appreciate their humor, quirks, and personalities, and this comfort later helped the whole team get down to productive work very quickly. By integrating sites like Twitter, Flickr, and Google Docs into their collaborative workspace, Ayla and her colleagues were able to share and mold content quickly, creating a group presentation that had been tweaked, manipulated, and refined by each team member in a synchronous space.

Using a string of virtual documents and meeting notes as evidence of ongoing collaboration, Ayla was able to convince her graduate studies advisor that joining the team for an upcoming European conference was an important next step in sharing their early research efforts. The collaborative tools had helped her build proximity, working relationships, and friendships that otherwise would have been hampered by geographical distance.

Endnotes

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